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(54) Carpet backing materials, process for the manufacture thereof, and carpets incorporating same.

(57) The carpet backing materials comprise a woven, non-woven or knitted thermoplastic backing fabric, preferably at least partially incorporating polyolefin, in particular polypropylene, yarns, to which a fleece is adhered by means of a hot melt powder adhesive having a softening point below that of the thermoplastic backing fabric. The fleece may, if desired, be pretreated to form a self-supporting web prior to being adhered to the backing fabric. A process for the preparation of the carpet backing materials and tufted carpets incorporating the backing materials are described and exemplified.

When incorporated into tufted carpets, the backing fabrics avoid the problem of grinning, and improve tuft locking and dimensional stability of the finished carpets.

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by the needling process.

We have now found it possible to avoid all or some of the above-mentioned disadvantages, while at the same time avoiding the problems of grinning usually associated with the use of conventional polyolefin backings.

Thus, according to one embodiment thereof, the present invention provides a carpet backing material comprising a woven, non-woven or knitted thermoplastic backing fabric, preferably at least partially incorporating polyolefin yarns, to which a substantially flat fleece is attached, characterised in that the fleece is adhered to the backing fabric by means of a hot melt powder adhesive having a softening point below that of the thermoplastic backing fabric.

In a particular embodiment of the invention the fleece adhered to the backing fabric comprises at least a first fibre component whose fibres have a softening point above that of the hot melt adhesive and preferably below that of the backing fabric, and prior to adhesion of the fleece to the backing fabric the fleece has been heated to a temperature equal to or greater than the softening point of the said first fibre component to cause the fleece to form a self-supporting web.

According to another embodiment, the invention provides a process for the manufacture of a carpet backing material which comprises attaching a substantially flat fleece to a woven, non-woven or knitted thermoplastic backing fabric, characterised in that a hot melt powder adhesive having a softening point below the softening point of said thermoplastic backing fabric is applied to the backing fabric, the backing fabric and applied adhesive powder is heated to a temperature sufficient to melt and fuse said adhesive to the backing fabric but below the softening point of the backing fabric to form a coated backing fabric, and subsequently the fleece is applied to the coated fabric while the adhesive is still active in order to adhere said fleece to the coated fabric. For the manufacture of the carpet backing according

comprises at least a first fibre component whose fibres have a softening point above that of the powder adhesive and preferably below that of the backing fabric and prior to adhesion of the fleece to the coated fabric the fleece is heated to a temperature equal to or greater than the softening point of the fibre component to cause it to form a self-supporting web.

The thermoplastic backing fabrics used in the preparation of the carpet backing materials according to the invention may be any of the known fabrics incorporating polyolefin yarns, but are preferably those incorporating polypropylene yarns. Examples of such fabrics are any of the known woven fabrics formed with polypropylene ribbons or tapes in both the warp and weft yarns and those in which all or some of the warp and/or weft yarns are replaced by continuous or spun filamentary yarns either of polypropylene or some other material. A particular example of such a fabric is that having warp yarns of polypropylene ribbons and weft yarns of continuous or spun polypropylene filaments, or of fibrillated or twisted tapes of polypropylene.

Other thermoplastic materials which may be used in the backings of the invention include polyamides, polyesters, polyacrylates and polyvinyls.

The hot melt powder adhesive used in the preparation of carpet backing materials according to the invention may be a thermoplastic or thermosetting powder adhesive having a softening point below that of the thermoplastic backing fabric and also a softening point below that of at least one of the fibre components of the applied fleece. Suitable adhesives include those based on copolymers of ethylene and vinyl acetate provided they have the above-mentioned softening characteristics. The hot melt powder adhesive may be applied to the backing fabric in the process according to the invention by a

powder point coating technique (in which case the powder adhesive has a maximum particle size preferably of 200 μm) or by a scatter point coating technique (in which case the powder adhesive has a maximum particle size advantageously of 300 μm). The adhesive may conveniently be applied in an amount of not less than 5 grams per square metre ($g.m^{-2}$) of backing fabric, and preferably in an amount of 10 to 25 $g.m^{-2}$. After applying the powder adhesive to the backing fabric, the coated fabric in the process according to the invention is then heated to a temperature sufficient to melt and fuse the powder adhesive to the fabric but below the softening point of the fabric. This heating is conveniently effected by passing the coated fabric through an infra-red oven but any other suitable technique may be employed. If desired, the fabric may be pre-heated to a temperature below the softening point of the powder adhesive prior to application of the powder adhesive to the fabric.

While the adhesive is still tacky, the fleece is laminated with the adhesive coated fabric and this is conveniently effected by passing the fleece simultaneously with the fabric through at least one nip of a smooth laminating roller calender system. This calendering process is effected at a temperature at or above the softening point of this hot melt adhesive. Prior to laminating, the adhesive coated fabric may be passed round a heated drum to maintain the activity of the adhesive.

After calendering, the finished backing material is cooled and may if desired be re-rolled to give a smooth surface to the final product. Moreover, any textile dressings may be applied at this point.

The fleece used for the preparation of backing materials according to the present invention desirably comprises one or more fibre components, at least one of which should have dyeing characteristics compatible with the

face pile material to be used in the manufacture of the finished carpet. In this context we have found it convenient to use a fleece comprising a component which, in carpet backings according to the particular embodiment of the invention, is a component having a softening point above that of the first component) of nylon 6, although other nylons, such as nylon 66, or other textile fibres e.g. rayon may be used, either alone or in admixture with nylon 6, for this purpose. It is advantageous to incorporate at least 70% of a component having favourable dyeing properties into the fleece.

In the preparation of carpet backings according to the particular embodiment of the invention, the first fibre component of the fleece should have a softening point below that of the thermoplastic fabric and above that of the powder adhesive and prior to incorporation of the fleece into the backing materials, the fleece is heated to a temperature equal to or greater than the softening point of this first component but below that of the thermoplastic backing fabric. This heat treatment may be effected by passing the fleece through a pair of rollers at least one of which is heated. This process causes at least some of the first fibre component of the fleece to at least partially melt or soften and thereby bond both to fibres of the second component and to similar fibres of the first component. This produces a relatively stable self-supporting web, and enables fleeces of lower weight to be used in the preparation of carpet backing fabrics compared to fleeces used in FLW backings.

In general, we have found it possible to use fleeces having weights in the range from 5 to 200, preferably 10 to 70 $g.m^{-2}$. The lower limit to the weight range is determined by the necessity to produce a good covering of the woven backing fabric and the upper limit being consistent with economical considerations.

In the individual fibre components of the fleeces, it will be appreciated that it is possible to use entirely virgin fibres, that is new fibres, or, for economy, to replace at

least a part of the fibres with waste or regenerated fibres.

It is also possible to incorporate further fibres into the fleeces for use according to the invention. Thus, for example, minor amounts of polypropylene fibres may also be incorporated, but in general and as indicated above, the fleeces should contain at least 70% of fibres having dyeing characteristics consistent with those of the face fabric to be used in the finished carpet. If desired, any or all of the individual fibre components of the fleece may be pre-dyed prior to incorporation into the fleece.

In a preferred embodiment of the invention, a fleece having a weight of 20 to 40 $g.m^{-2}$ is used. Such a fleece may be conveniently prepared by an air-lay or cross-lap fleece forming process of known type. The fleece may comprise fibres of nylon-6 (m.p. 215°C), which in a fleece according to the particular embodiment of the invention may form a second fibre component in an amount of up to 98%, e.g. from 70 to 98% by weight (referred to the total fleece weight), and such fibres should generally have a count of not less than 1.2 dtex, and a fibre length of not less than 5 mm. Up to 100% of these fibres may consist of reprocessed nylon-6 fibres. All or a part of the fibres may be replaced by nylon-66 or other textile fibres e.g. rayon.

The first component of the fleece according to the particular embodiment comprises fibres having a lower melting point than that of the thermoplastic fabric and above that of the powder adhesive, such as for example the nylon designated as K115 (manufactured by Grilon) which has a melting point of 115°C. The fibres of the first component are conveniently present in an amount of 2 to 100% e.g. 2 to 30% by weight (referred to the total fleece weight), and should generally have a count of not less than 1.2 dtex and a fibre length of not less than 5 mm.

The fleece may, if desired, be pre-bonded to form a self-supporting web prior to being adhered to the backing fabric.

After forming the fleece according to the particular

embodiment, this is heat treated by passing it through the nip of a pair of rollers, one of which is heated to a temperature above the melting point of the first fibre component of the fleece, for example at about 140°C. By this process a fleece suitable for incorporation in the backings according to the invention is formed.

According to a further embodiment, the invention also provides tufted carpets incorporating a carpet backing according to the present invention. Thus, the laminated carpet backings according to the invention may be tufted with face pile materials in a manner known per se. The resulting intermediate carpet may then be dyed and an adhesive layer, such as of latex, applied to permanently lock the tufts to the carpet backing. If desired, a secondary carpet backing may be applied to the carpet.

It is also possible to dye the carpet backing according to the invention prior to tufting, or alternatively to dye the fleece prior to its lamination with the woven backing fabric.

In order to effect an improvement in economy, it is possible to apply the fleece to the backing fabric over a width narrower, e.g. 18-20 cm narrower, than the full width of the backing fabric, so that the fleece is only present within the area to be tufted in the manufacture of the finished carpets according to the invention.

We have found that the use of the carpet backings according to the invention in the construction of tufted carpets, may not only avoid grinning by virtue of the incorporation of a relatively more easily dyed fleece but may also enhance the tuft locking of the face fabric to the backing. In addition, we have found that compared with FLW backings, the carpet backings of the present invention are less liable to shed fibres during dyeing of the intermediate carpets and later from the finished carpets. Moreover, the carpet backings according to the present invention may be produced having a smooth level surface. Furthermore, the use of adhesive in the preparation of the backing results in an

increased stability of the weave lock of the woven backing fabric and this may serve to improve the dimensional stability of the finished carpet.

The invention is further illustrated by the following non-limiting Examples.

Example 1

a) Manufacture of fleece

A fleece having a weight of 30g.m^{-2} is formed on a fleece forming machine (type V21-K12, manufactured by Dr. Ernst Fehrer, Textilmaschinefabrik und Stahlbau G.m.b.H. of Linz, Austria) and containing 15% by weight of nylon fibres (6.35 dtex; and length about 60 mm; sold as Grilon K115), 35% by weight of virgin nylon-6 fibres (3.3-3.9 dtex; and length about 60 mm; sold as Grilon CS3), and 50% by weight of reprocessed nylon-66 fibres (3.3-3.9 dtex; and length about 50-60mm).

b) Manufacture of carpet backing

A polypropylene backing fabric having a construction of 94 x 43 threads per 10cms (555 dtex warp yarn and 1220 dtex weft tape) and a weight of about 110 g.m^{-2}, was coated on a powder scatter coat machine (manufactured by Saladin A.G. of Sirnach, Switzerland) with 12 g.m^{-2} of an ethylene-vinyl acetate copolymer powder adhesive (m.f.i, 160; stated particle size, 0 to 300μm), at a rate of 4 m.min^{-1}. The coated fabric was passed through an infra-red oven at a temperature of 120°C to fuse the adhesive. The coated fabric is then passed in line to a laminating calender while the adhesive is still tacky and the fleece manufactured above is simultaneously passed to the top nip of the calender whereby the fleece is bonded to the backing fabric. The laminating calender bowl is at a temperature of 140°C. After cooling and re-rolling a carpet backing is obtained having a good bond between the fleece and backing fabric.

If the above process is repeated with an adhesive powder coating of 20 g.m^{-2} and a laminating calender bowl temperature of 170°C, a carpet backing may be produced at a rate of 40 m.min^{-1}.

Example 2

a) Manufacture of fleece

A fleece prepared according to Example 1a) is fed to the nip of a laminating calender (manufactured by Saladin A.G. of Sirnach, Switzerland). The calender consists of a polished steel drum heated to a temperature of 140°C and a rubber-press roller whereby pressure may be applied to the fleece as it passes between the steel drum and the rubber roller. The fleece is passed at a rate of 4 $m.min^{-1}$ through the calender, and a fleece in the form of a self-supporing web is obtained.

b) Manufacture of carpet backing

A carpet backing is prepared in similar fashion to Example 1b) using the fleece prepared in Example 2a) above. A carpet backing is obtained having a very good bond between the fleece and backing fabric.

If the above process is repeated with an adhesive powder coating of 20 $g.m^{-2}$ and a laminating calender bowl temperature of 170°C, a carpet backing may be produced at a rate of 40 $m.min^{-1}$.

Example 3

Manufacture of Carpet

A carpet 1 metre wide was tufted on a 1/8 gauge machine at 28 stitches per 10 cm with nylon face yarns to give a face weight of 320 $g.m^{-2}$ using a backing manufactured as described in Example 2b) with the exception that nylon-6 was substituted for nylon-66.

A comparison carpet was manufactured in the same way using a known FLW backing.

Both carpets were dyed in a winch dye beck and then precoated and foam backed to produce a finished product.

Both carpets were tested, and the following results obtained: -

a) Fabric breaking strain in warp and weft directions, and tuft retention of unbacked dyed carpets

improvement in retained warp strength and a 5% improvement in retained weft strength, compared to the comparison carpet.

The tuft retention factor was found to be 82% higher than that achieved with the comparison product.

b) Fabric breaking strain in warp and weft directions, and weft retention of dyed and precoated carpets

An 18% improvement compared to the comparison carpet in retained warp strength was achieved in the carpet according to the invention. Weft strength in both carpets were similar.

The tuft retention strength of the carpet according to the invention was 34% higher than the comparison product.

c) Delamination of foam backed carpets

Backing delamination in both carpets was good, the carpet of the invention giving results in the region of 7% higher than the comparison product.

In addition, the carpet manufactured according to the invention exhibited good anti-fray properties.

Carpet backing materials, process for the manufacture thereof, and carpets incorporating same

This invention relates to backings suitable for use as carpet backings, especially tufted carpet backings, process for the manufacture thereof, and to carpets produced therefrom.

Over the last few years, conventional tufted carpet backings manufactured from natural materials such as jute, cotton, sisal and the like, have been increasingly replaced by carpet backings woven from polyolefin, and especially polypropylene, yarns. Backing fabrics woven from polyolefin yarns have many advantages over those manufactured from the above-mentioned natural materials. In particular they are harder wearing and are more economical. They are also highly resistant to staining as well as being impervious to water and exhibit good dimensional stability.

However, although exhibiting the above-mentioned advantages, polyolefin backing fabrics are not readily dyed, and it is not therefore easy to achieve a uniformity in dyeing between the backing fabric and the face material of the carpets produced therefrom. Such a desired uniformity is difficult to produce due to the widely differing dyeing characteristics of polypropylene and fibre materials, such as nylon, used in the face fabrics. Moreover, the polypropylene yarn in the backing is normally in the form of a tape which has an unacceptably high light

together commonly give rise to the property known as "grinning", that is the backing material is clearly visible when the finished carpet is bent and an overall appearance of lack of uniformity of colouration is manifested.

Various solutions have been proposed for overcoming this problem. Thus, it has been proposed to use special techniques to enable both the backing and face fabric to be dyed in one operation, but these have not proved to be acceptable.

It has also been proposed to attach a fleece or web to a woven polyolefin backing fabric prior to tufting by needling the fleece into the backing fabric. This type of backing is hereinafter referred to as "fibre lock weave" (or "FLW") backing. By this method a fleece having improved dyeing characteristics is attached to the polyolefin backing. When such a fleece is made from nylon, a composite backing fabric may be produced which largely overcomes the problem of grinning. However, various disadvantages arise both in the manufacture and use of FLW backings. Firstly, production speeds of the finished backing may be adversely affected by the needling process owing to the low production rates obtainable with the latter. Secondly, FLW backings often exhibit an undesirable "lumpiness", which results in an uneven appearance in the final carpet as well as an uneven dyed appearance. Thirdly, the covering power of the fleece is in part diminished by the needling process due to the unavoidable necessity to push some of the fibres of the fleece through the backing to achieve the fibre lock effect. Fourthly, the nature of the fleece, which has a loose surface, may lead to processing difficulties; in particular, fibre loss from the fleece occurs in the dyeing process and the shed fibres cause clogging of filters used therein. Fifthly, in order to achieve relatively good results with adequate cover, FLW backings generally require the incorporation of fleeces having high weights and this may make the backings relatively expensive. Finally, the good dimensional stability usually associated with polyolefin backings may be prejudiced due to

CLAIMS

1. A carpet backing material comprising a woven, non-woven or knitted theromplastic backing fabric to which a substantially flat fleece is attached, characterised in that the fleece is adhered to the backing fabric by means of a hot melt powder adhesive having a softening point below that of the thermoplastic backing fabric.

2. A carpet backing according to claim 1, characterised in that the fleece adhered to the backing fabric comprises at least a first fibre component whose fibres have a softening point above that of the hot melt adhesive and prior to adhesion of the fleece to the backing fabric the fleece has been heated to a temperature equal to or greater than the softening point of the said first fibre component to cause the fleece to form a self-supporting web.

3. A carpet backing according to claim 1 or claim 2, characterised in that the backing fabric at least partially incorporates polypropylene yarns, and the fleece comprises nylon-6 and/or nylon-66.

4. A process for the manufacture of a carpet backing material according to claim 1 which comprises attaching a substantially flat fleece to a woven, non-woven or knitted thermoplastic backing fabric, characterised in that a hot melt powder adhesive having a softening point below the softening point of the backing fabric is applied to the backing fabric, the backing fabric and applied powder adhesive is heated to a temperature sufficient to melt and fuse said adhesive to the backing fabric but below the softening point of the backing fabric to form a coated backing fabric and subsequently the fleece is applied to the coated backing fabric while the adhesive is still active in order to adhere said fleece to the coated fabric.

5. A process according to claim 4, characterised in that the fleece comprises at least a first fibre component whose fibres have a softening point above that of the powder

adhesive and prior to application of the fleece to the coated backing fabric the fleece is heated to a temperature equal to or greater than the softening point of the fibre component to cause it to form a self-supporting web.

6. A process according to claim 4 or claim 5, characterised in that the backing fabric at least partially incorporates polypropylene yarns and the fleece comprises nylon-6 and/or nylon-66.

7. A tufted carpet characterised in that it incorporates a carpet backing material according to any one of claims 1 to 3.

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EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	GB - A - 1 420 624 (J.C.J.) * Claims *	1
A	US - A - 3 734 800 (RYAN) * The whole document *	1
	US - A - 3 325 323 (FORKNER) * Claims; figures 2,3,11-15 *	1
	GB - A - 1 303 401 (BIGELOW-SANDFORD) * Claims; figures *	1

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TECHNICAL FIELDS SEARCHED (Int.Cl.³)

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CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
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P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

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The present search report has been drawn up for all claims

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A	US - A - 3 734 800 (RYAN) * The whole document * --	1	
	US - A - 3 325 323 (FORKNER) * Claims; figures 2,3,11-15 * --	1	TECHNICAL FIELDS SEARCHED (Int.Cl.³)
	GB - A - 1 303 401 (BIGELOW-SANDFORD) * Claims; figures * ----	1	D 06 M 17/00 D 04 H 13/00 A 47 G 27/02 D 06 N 7/00

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T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner